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## MINOR COMMUNICATIONS

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### ON THE ASSOCIATIVE POWER OF ODORS

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That odors have the power to recall the past with unusual vividness is an observation not infrequently to be met in general literature, and casual experience now and then seems to confirm it. Careful laboratory experiments on the other hand have given no evidence for such a pre-eminence.<sup>1</sup> The mediating fact seems to be that both the observations and the experiments are correct for the special conditions under which they have been made, and both misleading if incautiously generalized. Casual observation here, as usually, is struck by the exceptional and neglects the commonplace; it notes the cases where vivid memories are roused by odors, but fails to observe the vastly more numerous instances in which they suggest nothing old and nothing vivid. The odor of coffee, of kerosene, of illuminating gas, of coal tar, of fresh paint, of tobacco, are to most people no more definitely suggestive of the remote past than the sight of the same articles would be. It is clear, then, that if odors on some occasions give rise to vivid recollections, they must do so in virtue of some peculiarity in the odor or in the circumstances under which it is now or has previously been perceived.

In the writer's belief the essential features (after a suitable apperceptive mood at the time of forming the association and again at its recall) are simply that the odor shall be one that is not too frequently experienced, at least not so frequently experienced under varied conditions, that its preponderant association with one set of circumstances is weakened and blurred out by many others, and, as contributing to this last, an attitude of interest in the odor *per se* and not as merely means to an end.

It is not difficult to find analogous cases. Sense experiences in any field are apt, if they recall anything at all, to call up their circumstances vividly when these are unique and infrequent; but they lose that power when often repeated in many settings. Old tunes recall the past clearly if not heard too often; those heard frequently recall, as a rule, recent circumstances only or none at all. Faces known only in pictures and thus always seen from the same aspect (the common portraits of Washington, for example), are often recalled more definitely than the faces of one's own family which are seen from day to day in a hundred different aspects. In a word, when odors call up the past with definiteness, they probably do so because they are associated with comparatively little else than the circumstances which they recall, and if odors have such limited associations more frequently than sights and sounds, it is because they are less often and

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<sup>1</sup>Heywood, Alice, and Vortriede, Helen A.: Some Experiments on the Associative Power of Smells, this *Journal*, XVI, 1905, 537-541; and Bolger and Titchener, this *Journal*, XVIII, 1907, 326-327.

less attentively experienced. They are like ordinary photographs showing one image clearly, while sights and sounds (and "ordinary" odors) are like composite pictures in which so many faces are united that no one is clear above the rest.

The laboratory studies have not taken this feature into view and have therefore not succeeded in reproducing the essential conditions of the phenomenon as it appears casually, though at the same time they have made clear that odors as a class are probably without exceptional reproductive power—except such, perhaps, as may attach to them through their high affective coloration.

The experiments to be described in this paper are, it must be confessed, inadequate to a direct proof of the above hypothesis though they offer considerable indirect evidence for it. The method employed was the very simple one of presenting to the observers a series of odors under conditions which required the formation of certain definite new associations and noting the changes that took place in both the old and new associations as the latter were gradually formed; and later following this up by occasional testings at intervals of from a few days to several weeks and in some cases a number of months. The odors used were twenty-five easily obtainable ones which promised, nevertheless, to be unfamiliar enough not to be instantly named by the observers. No effort was made to select odors representative of the different odor groups of Zwaardemaker, but some of them were agreeable and some disagreeable. The new associations to be formed were with two-place numbers, one for each odor. The odors were placed in small bottles, all alike and all wrapped to the top in exactly the same way with blue paper and all labeled with gummed labels carrying the different numbers in large type.

In making a test the experimenter handed one of the bottles to the observer who uncorked it, took a whiff of the odor and gave its number if he was able (or, in the case of the first presentation, some indication of such associations as were called up by it, if any had appeared). The observer then looked at the number and tried in such manner as he pleased to connect it with the odor, after which he was given another bottle, and so on to the end of the series, when he reported anything with reference to the associations or their formation which he judged worthy of record.

In the earlier experiments the association did not become permanent until after several sittings, because too little attention was given to the number (seen and pronounced but a single time) even when only five bottles were used at a time; the odor, when it came, drove the number completely out of mind. Later when this defect was remedied by concentration of attention upon the number for fifteen or twenty seconds before taking a whiff of the odor a set of five odors could be connected with their numbers at a single sitting, though of course much more practice was required before the number came "direct," that is, came first, and without mediation, to consciousness.

Of the seven observers who served in these experiments two were university men, one a university professor, one a woman physician, one a nurse, one an artist and one a housekeeper. For convenience they will be designated by letter: *A*, *B*, and *F* were men; *C*, *D*, *E*, and *G* were women. Not many tests were made with *G*.

The following introspections reported at the close of the tests from time to time, give some indication as to the behavior of the old or earliest associations. The differences are probably due, as will be shown more fully later, to the mental attitude of the observer toward the whole experiment. The odors at the first sitting called up in *A*'s mind scenes of his childhood and an early apprenticeship in a drug

store; later he remarked that the associations were mainly with previous sittings in the present experiment and that as the odors came "direct" the old associations dropped out and did not even come secondarily; on still another day he spoke of them as being so "far in the background as to have given place entirely to the recent associations." Of somewhat similar tenor were the reports of *C*, the woman physician, who has a very keen sense of smell coupled with a lively visual imagination and has had, of course, daily experience with odors and some reason for attending to them. With this observer the odors at first had both the elements of remote and of recent experience. She used at different times in general introspection the following expressions: "The concrete associations are dropping out but with longer thinking they come back;" "the main associations are with the last time of smelling," the concrete associations are in the fringe of consciousness." At the last time she reported that the old associations were in the periphery of consciousness but staid there through the habit of ignoring them. *C* at first referred nearly all the odors to definite classes in *materia medica*, and the associations with experiences of childhood, though present, were relatively few. She easily became indifferent to the affective coloration of odors that were at first pleasant or the contrary, thus carrying over her professional attitude into a new field. These observations show the attitude that may be acquired toward the associations called up by odors, and at the same time confirm in their measure the hypothesis above propounded that the powerful associative quality of smells is due jointly to the infrequency of their occurrence and to the attitude or purpose with which they are received.

If for any reason the frequent experience of odors leads to the repetition of the old associations rather than the formation of new ones, a strengthening rather than a weakening of the old will naturally result; and something of this kind seems to have taken place with observers *B* and *D*. *B* had great difficulty at first in getting certain of the odors to come "direct" and remarked that the "associations already called up exclude all new ones." After the first three months' interval of no practice *B* said that for him the more ready recall of the number depended rather on the definiteness of the odor [*i. e.* its unlikeliness of confusion with others] than on the recency, yet as the experiment continued the associations were rather with previous sittings than with still earlier experiences. The first associations, had not really dropped out, but came up after the more recent ones.

*D*'s case was even more marked, for she reported an actual reinforcement of the first associations even to the end of the tests. She speaks nevertheless of a little association with other times of testing; and in connection with one odor, smelled again after a long interval, there was a distinct association with a door-bell interruption that had occurred with that odor at an earlier test. The attitude of observer *D* was quite different from that of *C*; her trend of interest was not at all professional but toward the odor itself and what it recalled. The various odors after practice brought their numbers directly indeed, but generally some association with early life or everyday scenes came up also. She did not, like the other observers, have in the tests after the longer intervals, associations with the previous times of learning. The emotional coloring seems to have led, as we have already suggested, to such a repetition and reinforcement of the primary associations as caused their persistence though secondary in point of time. A longer continuance of the practice with the new associations and a practical purpose in forming them would very likely have made them preponderant over the old, even in her case.

*F* after a five months' interval, on being tested, reported: "Associations in general are very meagre. However, all but one [of twenty odors] seem familiar. . . . Visual imagery, except in two cases, is not present at all. . . . There is really much less imagery than when I learned them and [in response to a question] there was not a single case of association now with the times of learning." The introspections of the other observers furnished little evidence on these points.

With reference to the formation of the new associations the experience of all the observers was tolerably uniform and such as one might expect it to be. The differences between the different subjects were mainly quantitative. In most cases the old associations tended in course of time to drop out and leave the name and the number to struggle together. The association of the odor with the number generally went through three distinguishable stages. In the first the name given to the odor, in many cases accompanied by visual imagery, would rise at once on the perception of the odor and be followed immediately by the number. The announcement of the observer in such cases would be, *e. g.*, "Tar-84." Such a stage would continue from 5 or 6 to 15 or 20 days, varying with the observer, the affective quality of the odor, the pitch of attention, the degree of familiarity, the general attitude of the observer, etc.

The transition from this first stage to the second was a gradual weakening or recession of the name, and a gain in certainty and promptness in the number.<sup>1</sup> In many instances, though not in the case of all associations that attained "directness," there came after the first a clearly marked, but often short, second stage when the word and the number seemed to rise together. This "simultaneous" phase did not often last more than one or two days, but there was more or less tendency to relapse into it when "directness" had been attained but not fully established. In the first stage there was often some discouragement, and such statements as "I believe these will never come 'direct'" were not unusual. When the "simultaneous" stage came there was a feeling of encouragement or success which seemed to hasten progress. In the third and last stage the association with the number was prompt and without mediation. The observer's announcement was: "84-tar." With practice the name retired still further into the background, coming later and later, until it finally ceased to appear, and the odor called up the number only.<sup>2</sup>

After intervals of rest of a week or more, and in the earlier stages even after the interval from Saturday to Monday, the new associations seemed noticeably weakened. *A*, for example, after an interval of ten days, when most of the numbers were nearly "direct", thought that all associations with the numbers had become a little uncertain as compared with what they were before. In at least two other instances, however, number associations once established showed great "directness" and persistence. *B* reported that several months after his last test he happened one day to get an odor to which he at once said only "76," and no old name followed. At about the same time *E*, fully two months after her last test, found spearmint growing wild. She caught the odor and at once said "63." In these we have apparently

<sup>1</sup>*A* remarked at an early stage that if for any reason the name was hindered in rising the number stood ready.

<sup>2</sup>Complete unfamiliarity in the odor favored the prompt association of it with its number. To *E* number 41 was so unfamiliar that she had no other name or association with it and hence the number 41 served itself as a name and became almost immediately "direct."

chance cases on a small scale of the same "unusual" reproductive power of odors which we are endeavoring to explain.<sup>1</sup>

With certain subjects a prominent factor in the learning of the numbers was the formation of mnemonics, for example, "63, three, tree, herb, mint." While of some advantage in the first fixing of the numbers, these often seemed to hinder in the "coming direct," the mnemonic links being especially persistent. Others made use of incidental helps. *C*, for example, was inclined to set the odor in its place in the series as given at the first test. *A* had also a similar tendency, and when two groups of five were thrown together he confused the two that had been originally at the middle of the separate groups. He also noted other general confusions from running two groups together. *B* also, after he had had two or three different series of five, would fumble considerably at the beginning of any test if he had not been told that the first, second or third series was to be used. Two or three mistakes might be made (imaginings of other series) until the proper set of associations was brought into play by some odor more distinct than the rest. *F* presented the unusual but interesting ability to give the approximate numerical location of any odor in the entire series, at the same time showing considerable difficulty in getting the numbers exactly, saying, for example, "Well, that's in the fifties," or "that's up near the nineties." He could not give any definite introspection as to his manner of locating them, but it seems to point to some sort of number-form, influential though far in the periphery of consciousness. *A* also, who has a definite number-form, had something of the same power of approximate location.

The affective qualities of the odors seem to have played a certain subordinate role in the fixing of the associations, some distinctly pleasant (and in a few instances some distinctly unpleasant) having formed especially prompt and lasting associations with their numbers; but our evidence on this matter is meagre. Certain remarks of the observers suggest, also, another and closer point of connection of affective qualities with our main question. Odors, as a rule, carry a strong affective coloration, but this is weakened and in some cases nearly disappears with frequent experience of them. With *C*, it was noted as has been said that the feeling element seemed to fall away as testing with the odors was continued. It also returned again in a measure after about a month's interval of no work with them, as was observed on two separate occasions. It would seem, therefore, that the feeling coloration of the odors and their tendency to recall early associations run a somewhat parallel course, which next suggests the question whether the feeling is not itself an important link in the recall. The data furnished by the present experiment throw no further light upon the matter, but an affirmative answer would seem not unlikely.

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<sup>1</sup> Observer *C* showed the interesting case of two odors the numbers for which had not yet become established as "direct," but nevertheless rose without intermediary after a six weeks' interval.